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EPA Superfund
Record of Decision Amendment:

SAND CREEK INDUSTRIAL
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OU 05
COMMERCE CITY, CO
09/08/1993

DECLARATION STATEMENT
FOR
AMENDMENT TO THE SEPTEMBER 28, 1990
RECORD OF DECISION
SAND CREEK INDUSTRIAL SUPERFUND SITE, COMMERCE CITY, COLORADO
OPERABLE UNIT 5

SITE NAME AND LOCATION

Operable Unit 5 (OU5) - Colorado Organic Chemical Company Shallow Soils, Sand Creek Industrial Superfund Site, Commerce City, Colorado.

STATEMENT OF BASIS AND PURPOSE

This decision document is an amendment to the Record of Decision (ROD) signed September 28, 1990 and presents the new selected remedial action for cleanup of contaminated shallow soils at OU5 at the Sand Creek Industrial Superfund Site. OU5 is located immediately north of 52nd and Dahlia Street in Commerce City, Colorado. This ROD Amendment is undertaken pursuant to the requirements delineated in Section 300.435(c)(2)(ii) of the National Contingency Plan (NCP) and Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

This decision document explains the basis for selecting a different remedy for the cleanup of contaminated shallow soils at OU5 than that selected in the September 1990 ROD. The information that forms the basis for this remedial action decision is contained in the Administrative Record for OU5 and is summarized in the attached Decision Summary. The State of Colorado concurs with the new selected remedy for cleanup of contaminated soils at OU5.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD Amendment, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF NEW REMEDY FOR CONTAMINATED SOILS

The new selected remedy for OU5 addresses shallow soils contaminated with pesticides and metals in the Colorado Organic Chemical Company area at the Sand Creek Industrial Site. The major components of the September 1990 ROD were excavation and soil washing treatment of contaminated shallow soils, incineration of soil wash residuals, backfilling of the treated soils, and grading and revegetation of the site. Based on new technical data and cost information obtained subsequent to the September 1990 ROD, EPA has reconsidered its decision to employ soil washing and incineration of the generated residuals as a source control measure for OU5. New data evaluated by EPA included technical data on contaminant removal efficiency via soil washing and cost information for incineration received during the remedial design for OU5. Other components of the September 1990 ROD are not affected by this new information.

The new remedial action selected by EPA for OU5 involves treatment of the contaminated soils and includes the following principal components:

- Excavation of contaminated soils and treatment in an on-site low-temperature thermal treatment (LTTT) facility,
- Off-site treatment (regeneration) of spent activated carbon, and
- Backfilling of excavated areas with treated soil and revegetation of the site to minimize erosion and dust emissions.

STATUTORY DETERMINATIONS

The new selected remedy in this ROD Amendment is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Jack W. McGraw

Jack W. McGraw, Acting Regional Administrator
U.S. Environmental Protection Agency, Region VIII

9/8/93
Date

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AMENDMENT TO THE SEPTEMBER 28, 1990
RECORD OF DECISION
SAND CREEK INDUSTRIAL SUPERFUND SITE, COMMERCE CITY, COLORADO
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I. INTRODUCTION

This document summarizes the information that forms the basis for EPA's selection of a new remedial action for treatment of contaminated shallow soils at Operable Unit 5 (OU5) at the Sand Creek Industrial Superfund Site in Commerce City, Colorado. This ROD Amendment will become part of the Administrative Record pursuant to Section 300.825(a)(2) of the NCP.

In September 1990, EPA issued a ROD for OU5 which selected soil washing with off-site incineration and disposal of contaminated residuals as the preferred alternative for remediation of contaminated shallow soils at OU5. However, during the Remedial Design (RD) phase the objectives of the ROD were found to be unachievable because: (1) soil washing would not reduce the contamination to the cleanup levels specified in the 1990 OU5 ROD, and (2) the cost of soil washing is 3 to 4 times greater than originally estimated in the ROD.

In response to this information, EPA and CDH performed additional sampling of OU5 soils, updated the evaluation of the health risks associated with exposure to the contaminated soils, and studied additional remedial technologies as an alternative for cleaning up the OU5 soils. The original ROD, which was signed on September 28, 1990, is attached to this document as Appendix A, and should be referred to for further information regarding the site description, history of operations, enforcement activities, and community relations prior to September 1990. This OU5 ROD Amendment documents modifications to the original 1990 ROD.

II. COMMUNITY PARTICIPATION SINCE THE SEPTEMBER 1990 ROD

Community interest at OU5 generally has been low, with involvement primarily from a few residents and businesses located in the vicinity of the site. The public participation requirements as specified in CERCLA Section 113(k)(2)(B)(i-v) have been met as described below.

In June 1993, EPA sent a fact sheet to 988 persons on the mailing list that included residents, business owners, and public officials. This fact sheet described the Proposed Plan to amend the September 1990 ROD for treatment of contaminated shallow soils at OU5. The fact sheet also described opportunities for public involvement, including the public meeting on June 29, 1993 and the public comment period for the Proposed Plan from June 17 through July 19, 1993. In addition, on June 15, 1993 EPA placed public notices in the *Denver Post* and *Commerce City Express* announcing the public meeting and comment period, and informed the public of the availability of pertinent information at the information repositories.

The public meeting, to discuss the new Proposed Plan was held on June 29, 1993 at the Commerce City Recreation Center at 5:30 pm. A transcript of the meeting was prepared for placement in the Administrative Record files at the information repositories. Two individuals attended the meeting and no significant comments were presented. EPA received no written comments during the comment period for the OU5 Proposed Plan.

III. SITE ACTIVITIES SINCE THE SEPTEMBER 1990 ROD

During the Remedial Design (RD) phase, several activities were conducted at OU5, as discussed below:

A. Soil Sampling

Soil sampling (Phase 1) was conducted by EPA and CDH in July 1992 to accurately determine the variability of pesticide contamination on the OU5 property and to establish more precise soil volumes requiring remediation than could be estimated from the RI data. To better define the location and magnitude of contamination, the sampling was performed on six Environmental Units (EUs). Each EU covered an area of 50 by 50 feet and was further subdivided into 25 subunits each measuring 10 by 10 feet. The EUs were located in areas with elevated dieldrin and heptachlor contamination, based on data from the Remedial Investigation (RI). Within each EU, 6 of the 25 subunits were randomly selected for sampling for a statistically representative evaluation. Soil samples from the surface to one foot depth were collected from each sampling location, and an aliquot from each of the six grab samples was combined to form a composited sample for each EU.

A Phase 2 sampling effort was planned to determine the accuracy of field immunoassay test kits for pesticides in soil samples. Field and laboratory results were to have been compared to assess the accuracy of the test kits. However, Phase 2 sampling was canceled because no adequate immunoassay test kits were available.

In October 1992, a more extensive sampling effort (Phase 3) was performed by EPA on 138 EU subunit locations. The EU subunits are areas identified in the ROD as contaminated from depth increments of 0-1,1-3, and/or 3-5 ft. Soil samples were collected from the three

depth increments at each sampling location. In addition, at each EU subunit where the September 1990 ROD indicated contamination existed to a depth of 5 feet, a sample was collected from the 5-7 ft. depth interval. The analytical results from this sampling were used as confirmation for the depth of the contamination. The primary objectives of this sampling effort were:

- To further define the extent of soil contamination prior to excavation. This information was also used to re-calculate the volume of soil requiring remediation.

- To determine the quantity of fine-grained materials. The fine fraction segregated by the washing process is highly contaminated and must be incinerated and disposed of off-site.

- Provide analytical data for development of a pilot test evaluation.

In the Phase 3 sampling effort, a total of 259 pesticide samples, 97 samples of total metals, and 176 volatile organic compound (VOC) samples were analyzed. In addition, a total of nine soil samples were collected for geotechnical testing. Geotechnical samples were tested for moisture content, dry unit weight, specific gravity, grain size analysis, and Atterberg limits.

The results of the Phase 3 sampling indicated that concentrations of dieldrin were less than those estimated in the 1990 ROD and were highest in the shallow sample depth increments. Concentrations of heptachlor were greater than the original OU5 ROD estimates and increased with depth. Arsenic concentrations were typically less than values presented in the RI. The extent of contamination based on the Phase 3 sample results generally coincided with estimates presented in the 1990 OU5 ROD. However, there appeared to be little relationship between metals and pesticide occurrence.

B. Treatability Studies

In October 1991, the U.S. Army Corp of Engineers conducted a bench-scale treatability study to evaluate the effectiveness of the soil washing process for removal of organochlorine pesticides. Results of these tests were not conclusive since the soil samples used in the study did not contain contaminant concentrations elevated above action levels. Consequently, a pilot study was needed to effectively evaluate the performance of the soil washing process on contaminated soils.

In the fall of 1992, the EPA Volume Reduction Unit (VRU), a type of mobile small-scale soil washing unit, was brought to OU5 to perform on-site soil washing tests. This pilot-scale test was designed to provide a more comprehensive evaluation of the remediation costs and effectiveness of soil washing for the removal of contamination in the OU5 soils. Due to the heterogeneity of soils at OU5, soils from two separate contaminated areas were sampled at

three depth intervals. Samples from the three intervals were composited and chemically analyzed for use in the pilot-scale treatability study. Using these samples, with a wide range of soil contamination, the pilot study was better able to model the varying concentrations of contaminants to be encountered in a full-scale soil washing operation.

A total of 23 experimental runs were conducted during the pilot treatability study. The following variables were evaluated to assess the effectiveness of the soil washing under different operating conditions:

- Soils from three different depth increments (0-1, 1-3, and 0-5 ft.) were collected to evaluate effects of soil type at depth.

- Several types of surfactants were tested to evaluate their contaminant removal efficiency at OU5. Sodium Dodecyl Sulfate (SDS), a combination of Adsee 799 and Witconol NP-100 (50/50 ratio), and Tergitol 15-S-9 were selected due to their documented ability to remove dieldrin, heptachlor and other organochlorine pesticides from soils.

- Four surfactant concentrations at 0, 0.4, 1.0, and 1.5% (percentage of surfactant to water) were used to evaluate the effects of different surfactant concentrations.

- Two liquid to soil (L/S) ratios (6:1 and 9:1, by volume) to evaluate the effects of the L/S ratio.

- Two temperatures (ambient and 130°F) were used to evaluate the effects of temperature.

- Two pH levels (7.0 and 10.0) were used to evaluate the effects of pH on contaminant removal efficiency.

- Both single and double washes were used to evaluate the effects of re-washing contaminated soil.

Results from the tests indicated that soil washing could reduce dieldrin and heptachlor concentrations in OU5 soils, but could not achieve action levels established in the September 1990 ROD. In addition, it was determined that remediation costs with this technology would be 3 to 4 times greater than originally estimated in the ROD.

Due to the unsatisfactory performance of soil washing on OU5 soils and the much higher than anticipated costs associated with this alternative, additional remediation processes were evaluated in a technology assessment during the winter of 1993. The technology assessment evaluated the capabilities, availability, and applicability of the following processes: low-temperature thermal treatment (LTTT), ex-situ vitrification, off-site incineration, and on-site

and off-site disposal. These processes have the greatest potential for remediation of OU5 soils and were evaluated either alone or in conjunction with soil washing. The alternatives assembled were then compared based on the following factors: short-term protection of human health and the environment; long-term protection of human health and the environment; and reduction of mobility, toxicity, or volume of waste. Based on the limited bench-scale data for LTTT performance at approximately 700°F, residual concentrations of dieldrin and heptachlor well below the September 1990 ROD action levels appeared to be achievable. The LTTT process was also reported to be very effective in removing other pesticides of concern and was extremely cost effective in comparison with soil washing.

IV. SUMMARY OF SITE RISKS

A Risk Assessment (RA) prepared specifically for OU5 in 1990 established that a potential human health threat existed at OU5. Industrial workers in the area who were exposed to contaminants through the inadvertent ingestion of soil were considered to be the population at greatest risk. The OU5 RA identified: pesticides (dieldrin, heptachlor, chlordane and DDT); a herbicide (2,4-D); and metals (arsenic and chromium) as chemicals of concern (CoCs). The pesticides dieldrin and heptachlor were chosen as driver compounds for remediation of OU5 due to their carcinogenicity and concentrations. Data used in the OU5 RA indicated that by focusing on treating dieldrin and heptachlor to action levels of 0.155 and 0.553 mg/kg, respectively, an acceptable overall excess carcinogenic risk (for the occupational soil-ingestion pathway) of 2.7 in 100,000 (2.7E-05) would be achieved for OU5. The NCP specifies that action levels must be within the target risk range of 1 in 10,000 to 1 in 1 million (1.0E-04 to 1.0E-06). The extent of contamination from other identified CoCs was found from additional sampling to coincide with dieldrin and heptachlor contamination.

An analysis of the data collected in the fall of 1992 revealed that in addition to heptachlor and dieldrin, other contaminants, including chlordane, DDT, aldrin, toxaphene, and metals also contributed significantly to the carcinogenic risk at OU5. Consequently, a risk analysis which incorporated the new data was performed for OU5 in May 1993. The same exposure assumptions used in developing the 1990 OU5 RA were incorporated in the 1993 risk analysis.

Based on historical information regarding past activities at the Site, two distinct regions were established: (1) the railroad right-of-way in the northern area of OU5 and (2) the pesticide production and storage area (i.e., COC facility) in the southern portion of the site. To calculate health hazards associated with the new data, the soil ingestion scenario for workers was evaluated in both areas. In addition, risks posed to a child walking or playing (trespassing) in the railroad track area were assessed. In accordance with recent EPA guidance (Supplemental Guidance to RAGS: Calculating the Concentration Term, May 1992), average concentrations and Reasonable Maximum Exposure (RME) concentrations were calculated for all chemicals detected in the two areas. Risks associated with the pesticide production/storage area were calculated individually for the three soil intervals

sampled (i.e., 0-1, 1-3, and 3-5 feet deep). However, only the 0-1 foot soil interval was analyzed during the Phase 3 sampling investigation in the railroad right-of way area.

In the pesticide production/storage area (Tables 1, 2, and 3), the overall carcinogenic risk for workers exposed to contaminated soil was found to be an unacceptable hazard. Therefore, a comprehensive list of action levels was established for cleanup of the OU5 soils from health-based concentrations (HBCs) corresponding to a 1 in 100,000 (1.0E-05) carcinogenic target risk. This list is presented in Table 5 and includes action levels for chlordane, DDT, aldrin, and toxaphene as well as new action levels for arsenic, dieldrin, heptachlor, and other pesticides. Chromium is not considered by EPA to be carcinogenic via the ingestion route, but chromium does have a non-carcinogenic oral reference dose (RfD) that corresponds with a non-carcinogenic HBC (hazard index less than 1) of approximately 5,319 mg/kg. This value is well above the maximum chromium concentration (118 mg/kg) detected at OU5. The newly developed action levels are more comprehensive than those established in the 1990 OU5 ROD; however, the action levels for heptachlor and dieldrin are approximately 5 mg/kg and 1 mg/kg, respectively, less stringent than the original action levels. The higher action levels for heptachlor and dieldrin resulted from using a target risk of 1 in 100,000 (1.0E-05) for this ROD Amendment instead of the target risk of 1 in 1 million (1.0E-06) used in the 1990 OU5 ROD. The change in target risk used to establish action levels was made in response to recent EPA guidance.

In the railroad right-of-way area (Table 4), the total RME carcinogenic risk for workers due to exposure to pesticides, metals, and other organic compounds is approximately 5 in 100,000 (5.0E-05). The total RME carcinogenic risk for children walking or playing in the railroad right-of-way area is approximately 5 in 1 million (5.0E-06). The total non-carcinogenic hazards to workers and children in the region are both approximately 0.3 and, therefore, are below EPA's hazard index of concern (greater than or equal to 1.0). While a trespassing child represents the most likely current receptor and is exposed to no unacceptable risk, potential future risk to an industrial worker must also be considered in remediating the railroad right-of-way region at OU5. Consequently, it will be necessary to remediate 8 cells with CoC concentrations that exceed action levels out of the 73 50x50-foot cells established in this region. One cell located in this area exceeds the chromium action level via the inhalation pathway. The other 7 cells requiring remediation exceed either toxaphene or pesticide action levels. Soil contamination above action levels in the 8 cells is limited to a depth of 1 foot below ground. This cleanup action will ensure that no unacceptable carcinogenic risks are posed to workers and that the site will be unrestricted for industrial use in the future. Remediation of the railroad right-of-way area is complicated by the presence of railroad tracks, buried pipelines, and other utilities that will make cleanup of the area relatively expensive. Based on the depth of contamination, economic considerations and the most probable future exposure scenarios for workers, only the top foot of soil in those areas that exceed action levels in the railroad right-of-way will warrant clean up.

TABLE 1.
PESTICIDE PRODUCTION/STORAGE AREA AT OU5
(SURFACE TO ONE FOOT DEPTH)

CHEMICAL	FD* %	AVE CONC MG/KG	RME CONC MG/KG	MAX CONC MG/KG
Heptachlor	29/53	3.81	6.78	84.81
Dieldrin	45/53	4.29	7.87	109.81
Chlordane	44/53	4.55	10.68	55.01
DDT	45/53	10.36	15.56	65.70
Alpha-BHC	6/53	0.25	0.26	0.27
Beta-BHC	14/53	0.26	0.28	0.37
Gamma-BHC	14/53	0.26	0.28	0.43
Delta-BHC	13/53	0.26	0.28	0.50
Heptachlor E	22/53	0.50	0.72	4.21
Endosulfan	32/53	0.83	1.24	2.66
DDE	45/53	2.84	3.85	6.90
DDD	42/53	1.55	2.21	5.76
Endrin	21/53	0.87	1.44	2.25
Endrin a	6/53	0.26	0.28	0.84
Endrin K	22/53	0.66	0.96	4.78
Aldrin	11/53	0.40	0.61	6.64
Methoxychlor	9/53	0.28	0.31	0.71
Toxaphene	26/53	17.82	36.96	418.79
Arsenic	24/24	16.30	22.70	131.00
Chromium	24/24	12.80	17.10	37.50

TABLE 2.
PESTICIDE PRODUCTION/STORAGE AREA AT OU5
(ONE TO THREE FOOT DEPTH)

CHEMICAL	FD* %	AVE CONC MG/KG	RME CONC MG/KG	MAX CONC MG/KG
Heptachlor	32/59	8.75	16.85	249.42
Dieldrin	40/59	2.39	3.92	46.73
Chlordane	35/59	4.63	11.25	139.02
DDT	44/59	9.35	15.72	183.78
Alpha-BHC	11/59	1.66	3.37	58.03
Beta-BHC	15/59	0.55	0.90	11.93
Gamma-BHC	13/59	3.28	6.77	116.70
Delta-BHC	13/59	1.56	3.15	53.03
Heptachlor E	9/59	0.76	1.21	13.41
Endosulfan	16/59	0.65	1.01	7.50
DDE	42/59	1.34	1.71	6.84
DDD	32/59	0.92	1.39	5.46
Endrin	19/59	1.25	2.39	40.13
Endrin a	4/59	0.28	0.30	0.31
Endrin K	16/59	0.86	1.60	25.86
Aldrin	12/59	1.87	3.97	73.72
Methoxychlor	10/59	1.63	3.24	53.91
Toxaphene	26/59	11.00	98.09	134.12
Arsenic	22/22	5.50	9.90	58.10
Chromium	22/22	10.70	11.90	20.90

TABLE 3.
PESTICIDE PRODUCTION/STORAGE AREA AT OU5
(THREE TO FIVE FOOT DEPTH)

CHEMICAL	FD* %	AVE CONC MG/KG	RME CONC MG/KG	MAX CONC MG/KG
Heptachlor	15/36	11.28	28.35	364.15
Dieldrin	20/36	2.19	3.72	24.51
Chlordane	20/36	1.74	17.52	213.07
DDT	27/36	2.99	4.40	21.70
Alpha-BHC	4/36	1.06	2.01	17.93
Beta-BHC	7/36	0.39	0.52	32.26
Gamma-BHC	7/36	2.26	4.80	50.91
Delta-BHC	6/36	0.98	1.95	20.79
Heptachlor E	5/36	0.33	0.40	1.66
Endosulfan	9/36	0.52	0.85	6.87
DDE	25/36	1.40	2.00	11.45
DDD	22/36	1.25	2.56	28.84
Endrin	9/36	0.34	0.40	32.26
Endrin a	13/36	0.27	0.29	0.46
Endrin K	10/36	0.94	2.03	23.46
Aldrin	8/36	0.47	0.72	4.28
Methoxychlor	3/36	3.32	8.44	109.24
Toxaphene	6/38	2.55	4.99	26.16
Arsenic	22/22	3.10	4.60	20.40
Chromium	22/22	12.10	15.40	48.90

TABLE 4.
RAIL ROAD AREA AT OU5
(SURFACE TO ONE FOOT DEPTH)

CHEMICAL	FD* %	AVE CONC MG/KG	RME CONC MG/KG	MAX CONC MG/KG
Heptachlor	16/72	0.38	0.65	9.75
Dieldrin	36/72	1.42	2.55	38.36
Chlordane	37/72	1.74	4.59	12.35
DDT	41/72	3.59	6.08	20.14
Alpha-BHC	4/72	0.26	0.27	0.48
Beta-BHC	6/72	0.27	0.30	1.10
Gamma-BHC	8/72	0.28	0.31	1.43
Delta-BHC	5/72	0.27	0.29	0.82
Heptachlor E	5/72	0.37	0.51	2.40
Endosulfan	23/72	0.45	0.61	2.11
DDE	44/72	1.53	2.23	9.81
DDD	29/72	1.12	2.27	2.61
Endrin	4/72	0.46	0.69	4.58
Endrin a	1/72	0.27	0.27	0.27
Endrin K	6/72	0.57	0.61	1.37
Aldrin	3/72	0.28	0.29	0.87
Methoxychlor	5/72	0.28	0.30	0.86
Toxaphene	28/72	13.69	24.38	144.18
Arsenic	48/48	8.60	14.30	83.70
Chromium	48/48	14.80	22.80	118.00

*FD - Frequency of detection which is the number of samples analyzed for a particular chemical over the total number of samples taken for this specific location.

TABLE 5. HEALTH RISK-BASED ACTION LEVELS FOR OU5

CHEMICAL OF CONCERN	CONCENTRATION (mg/kg)
PESTICIDES	
Heptachlor	5.47
Dieldrin	1.54
Chlordane	18.9
DDT	72.4
α-BHC	3.91
β-BHC	13.70
g-BHC	18.9
Heptachlor E	2.71
DDE	73.2
DDD	104.0
Aldrin	1.45
Toxaphene	22.4
METALS	
Arsenic	12.7
Chromium	56.2

Action levels were developed based on 1.0E-05 target risk (excess lifetime carcinogenic risk) for all of the above chemicals of concern.

V. DESCRIPTION OF THE ALTERNATIVES

The principal goal in remediating OU5 is that same as stated in the September 1990 ROD; to return the site to industrial land use. Commerce City's Comprehensive Plan (1985-2010) indicates that present and future land use of this area will be primarily industrial with a recreational/openspace designation for the Sand Creek floodplain. The specific remedial action objectives at OU5 are: (1) source control of contaminated soils, and (2) mitigating risks or pathways for ingestion and direct contact with contaminated soils. Based on the risk analysis performed on data collected since the September 1990 ROD, the estimated volume of soils requiring remediation at OU5 has been decreased from 14,000 yd^3 to approximately 8,000 yd^3. This volume may be adjusted based on confirmation sampling of both treated soils and soils located at the perimeter of currently known contamination.

In addition to remedial alternatives, the NCP requires that a no-action alternative be considered at every site. This alternative serves primarily as a point of comparison for other alternatives. As in the 1990 OU5 ROD, the no-action alternative is unacceptable because it is not protective of human health or the environment and because a remedy can be implemented at the site. EPA's re-evaluation of the remedial alternatives identified two alternatives that are compatible with the remedial action objectives and current site conditions. The two alternatives are discussed and evaluated below:

1. Alternative 1: On-Site Soil Washing Treatment of Contaminated Soil/Off-Site Incineration and Disposal of Soil Washing Residuals (Originally Selected in the September 1990 ROD)

This alternative for treatment is unchanged from the September 1990 ROD except that the previous range of costs have increased due to market conditions. Soil contamination above action levels would be excavated and treated on-site using a soil washing process. Once the soil has been cleaned to required health risk-based levels, excavated areas would be backfilled with treated soil and revegetated in order to minimize erosion and wind-blown dust. However, based on treatability study data, it is uncertain whether soil washing can achieve all contaminant action levels established for OU5. The contaminated liquids and solids generated during soil washing would be removed from the site, incinerated, and disposed off-site in a RCRA Subtitle C landfill in accordance with Land Disposal Restrictions (LDRs).

2. Alternative 2: On-Site Low-Temperature Thermal Treatment (LTTT) of Contaminated Soils/Off-Site Treatment of Spent Activated Carbon

Soil contamination above action levels would be excavated and treated on-site using a LTTT process. LTTT is commercially available and has been shown to be effective in removing volatile organic compounds, including PCBs and pesticides, and metals, including arsenic from soil. Contaminated soils would be fed to a LTTT system that heats the soils to between 300-800° F and volatilizes the pesticides and arsenic. Contaminants released from

the soil would be transported in an enclosed gas stream that is sprayed with water to minimize dust generation, and the contaminants would be collected on a sulfur-impregnated activated carbon bed. Once the soil has been cleaned to required health risk-based levels, excavated areas would be backfilled with treated soil and revegetated in order to minimize erosion and wind-blown dust. In the event that the treated soils still contain elevated levels of metals, the soils would be re-treated in the LTTT unit. The spent activated carbon would be transported off-site and regenerated.

VI. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, alternatives developed for OU5 of the Sand Creek Industrial Superfund Site are evaluated and compared to each other using the nine evaluation criteria required by the NCP to identify the alternative that provides the best balance among the criteria. The relative performance of the alternatives is summarized by highlighting the key differences among the alternatives according to the following criteria:

1. Overall Protection of Human Health and the Environment
2. Compliance with Applicable, or Relevant and Appropriate Requirements (ARARs)
3. Long-Term Effectiveness and Performance
4. Reduction of Toxicity, Mobility, or Volume Through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance

The first two criteria are categorized as threshold criteria, in that alternatives must pass these criteria in order to remain in the evaluation. Criteria 3 through 7 are designated as balancing criteria. These criteria are used to measure the positive and negative aspects of performance, implementability, and cost for each alternative. The last two criteria are classified as modifying criteria.

A. Criterion 1: Overall Protection of Human Health and the Environment

This criterion assesses the protection afforded by each alternative, considering the magnitude of the residual risk remaining at the site after the response objectives have been met. Protectiveness is determined by evaluating how site risks from each exposure route are eliminated, reduced or controlled by the specific alternative. The evaluation also takes into account short-term or cross-media impacts that result from implementation of the alternative remedial activity.

Overall protection of human health and the environment would be provided by Alternatives 1 and 2 since both ensure that the soil is cleaned up for unrestricted industrial use. If some

soil requires additional treatment under Alternative 2 due to elevated concentrations of metals, the soil would be retreated. Both alternatives would reduce the potential health risks posed by direct contact with contaminants and would allow industrial use of the OU5 area. No institutional controls would be necessary once remediation is completed under either alternative.

B. Criterion 2: Compliance with ARARs

Section 121(d) of the Superfund Amendments and Reauthorization Act (SARA) mandates that for all remedial actions conducted under CERCLA, cleanup activities must be conducted in a manner that complies with ARARs, or if ARARs cannot be attained, a justifiable ARARs waiver must be obtained.

Both alternatives 1 and 2 would comply with ARARs (presented in Appendix A of the 1990 ROD). The ARARs associated with Alternatives 1 and 2 pertain to excavation, stockpiling, demolition, soil washing, LTTT, and backfllling activities for on-site operations, and hazardous waste transport, incineration emissions, and LDRs for off-site activities. During on-site operations, dust generation, excavation and treatment noise, and vapor emissions would be of concern. Workers would be required to follow OSHA health and safety regulations during all phases of the remedial action. Federal Clean Air Act National Air Quality Standards and State of Colorado Air Quality Regulations would require the control of vapor and particulate emissions.

In the 1990 ROD, the application of LDRs (40 CFR 268, Subpart D) was evaluated for soil washing (Alternative 1). LDRs generally require excavated soils to be treated to the "best demonstrated available technology" (BDAT) prior to being placed on the land or disposed of outside the area of contamination. However, it was determined that BDAT would be inappropriate and/or unachievable due to the complexity of the soil and debris mixture and that BDAT treatment may yield little benefit over other treatment methods. Consequently, a treatability variance was established to allow use of a treatment method other than BDAT for soils to be placed on-site. The highly contaminated (> 1000 mg/L) waste water and residual materials generated during soil washing would be taken off-site for incineration and disposal, as required by BDAT for California List fluids. For this ROD Amendment, health risk-based action levels have been established to determine both the soils requiring remediation and when soils are clean enough to be placed back on-site following treatment. A treatability variance is no longer necessary.

C. Criterion 3: Long-Term Effectiveness and Permanence

The focus of this evaluation is to determine the effectiveness of each alternative with respect to the risk posed by treatment of residuals and/or untreated wastes after the cleanup criteria have been achieved.

Both Alternatives 1 and 2 provide long-term effectiveness and permanence by removal and treatment of contaminated soils. Contaminants present in the residuals and wash-water in Alternative 1 would be destroyed by incineration. Similarly, the spent activated carbon resulting in Alternative 2 would be regenerated, thus destroying the contaminants.

D. Criterion 4: Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion evaluates the ability of the alternatives to significantly achieve reduction of the toxicity, mobility, or volume of the contaminants or wastes at the site, through treatment. The criterion is a principal statutory requirement of CERCLA. This analysis evaluates the quantity of contaminants treated and destroyed; the degree of expected reduction in toxicity, mobility, or volume; the degree to which the treatment will be irreversible; the type and quantity of residuals produced; and the manner in which the principal threat will be addressed through treatment.

Both alternatives 1 and 2 employ removal and subsequent destruction of contamination as a principal element, thereby reducing the toxicity, mobility, or volume of contamination. The treatment process is irreversible. On-site treatability studies and data from other Superfund sites indicates that Alternative 2 is superior to Alternative 1 with respect to the efficiency of contaminant removal from OU5 soils.

E. Criterion 5: Short-Term Effectiveness

The short-term effectiveness of each alternative was assessed based on the risk associated with the implementation of the remedial action to the community, workers, and environment and the time required to achieve the response objectives. Measures to mitigate releases and provide protection are central to this determination.

The evaluation of the alternatives indicate that both create some short-term risk in excavating and treating the soils, and transporting the contaminated materials off-site. A greater volume of contaminated material would be transported off-site in Alternative 1, compared with Alternative 2. Both alternatives involve risks associated with air emissions when the contaminated residual materials are incinerated. However, both alternatives would be required to meet local and state air emission standards.

F. Criterion 6: Implementability

Thus criterion analyzes technical and administrative feasibility, and the availability of services and materials. Technical feasibility assesses the difficulty of construction or operation of a particular alternative and unknowns associated with process technologies. The reliability of the technologies based on the likelihood of technical problems that would lead to project delays is critical in this determination. Necessary equipment, specialists, and additional resources are evaluated in determining the ease by which these needs could be fulfilled. The ability to monitor the effectiveness of the alternative is also considered.

Both Alternatives 1 and 2 are highly implementable, although Alternative 2 is easier since it does not require off-site incineration and disposal of contaminated materials. Off-site incineration involves transportation of contaminated materials and has the potential for air emissions due to fugitive dust. Additionally, off-site incineration has the potential for long-term off-site liabilities. Alternative 2 would require transport of relatively small volumes of spent activated carbon, has a much lower potential for air emissions due to fugitive dust releases, and a much lower potential for long-term off-site liabilities than Alternative 1. A much greater volume of water would be required during the treatment process for Alternative 1.

Both soil washing and LTTT are offered by various vendors, have been used successfully at several sites, and have available people skilled in the operation of these treatment systems. The typical commercial capacity available for soil washing and LTTT are 10 and 50 tons per hour, respectively. Therefore, the duration of soil remediation may be significantly less under Alternative 2 due to the larger capacity of the LTTT equipment. It is estimated that it would take 9 to 12 months to implement Alternative 1 and approximately 6 to 9 months for implementation of Alternative 2. Both alternatives are administratively feasible.

G. Criterion 7: Cost

Alternatives are evaluated for cost in terms of both capital costs and long-term operation and maintenance (O&M) costs necessary to ensure continued effectiveness of the alternatives. Capital costs include the sum of the direct capital costs (materials, equipment, labor, land purchases) and indirect capital costs (engineering, licenses, or permits). Long-term O&M costs include labor, materials, energy, equipment replacement, disposal, and sampling necessary to implement the alternative.

In comparison with Alternative 1, costs associated with Alternative 2 are much lower. The estimated capital (and total present worth) costs for Alternatives 1 and 2 are $13.9 million and $5.4 million, respectively. Under Alternative 1, the washing solution and treatment and disposal of contaminated wash-water and residuals at an off-site incineration facility are the primary components of the costs, in addition to the cost of equipment operators and electric consumption. For remediation of OU5 by soil washing, approximately 21-25% of fine-grained materials are estimated to require off-site transport for incineration, treatment (i.e., stabilization of waste contaminated with arsenic and chromium) and disposal. Although the fines would be dewatered prior to off-site transport, current technology available for dewatering results in the fine-grained fraction being 50% water. This significantly increases incineration costs. Permitting requirements and LDRs necessary to transport and dispose of the hazardous wastes may also substantially impact the cost for Alternative 1. There are no O&M costs associated with either alternative since the soil will be clean once the processes are completed.

H. Criterion 8: State Acceptance

This criterion evaluates technical and administrative issues that may be raised by the State. EPA has involved CDH throughout the RI/FS, RD, and remedy selection processes. The State of Colorado concurs with EPA's selected alternative, as presented in Section VII.

I. Criterion 9: Community Acceptance

This criterion evaluates questions and comments on the Proposed Plan received from members of the community. It appears that the community supports EPA's selected remedy, as presented in Section VII. No comments on the Proposed Plan were received by EPA during the public comment period. Therefore, preparation of a Responsiveness Summary for this ROD Amendment was not necessary.

VII. NEW SELECTED REMEDY

Based on the information available following the September 1990 ROD and EPA's consideration of the treatment alternatives for the contaminated shallow soils, EPA, with the concurrence of the State of Colorado, has selected Alternative 2 (On-Site Low-Temperature Thermal Treatment (LTTT) of Contaminated Soils/Off-Site Treatment of Spent Activated Carbon) as the preferred remedy for OU5. The selection of this remedy is based on the comparative analysis of alternatives presented above, and provides the best balance of tradeoffs with respect to the nine evaluation criteria. It is estimated that approximately 8,000 cubic yards of soil will require remediation at OU5. Cost estimates for the selected alternative are provided in Table 6.

The LTTT process heats the soil enough to volatilize pesticides and arsenic, but does not result in combustion or incineration. The degree of contaminant removal can be controlled by adjusting the feed rate and temperature. Contaminants released from the soil will be transported in an enclosed gas stream that is quenched with water to minimize dust generation, and the pesticides will be collected on a sulfur-impregnated activated carbon bed. Arsenic vapors will react with the sulfur to form a stable arsenic sulfide. Typical emissions to the atmosphere from a LTTT unit consist of water vapor.

The principal components of the new selected remedy include:

- All soils within the site boundaries (to a maximum estimated depth of 5 feet) contaminated above action levels in Table 5 will be excavated and treated with LTTT. The soils will be treated such that contaminant levels are at, or below, the action levels. Confirmation sampling will be performed to ensure that treated soils do not exceed action levels.

- The treated soils will be backfilled on the site.

- The site will be revegetated in order to minimize erosion and dispersion of soil from OU5.

- The spent activated carbon from the LTTT unit will be transported off-site and regenerated.

The advantages of the selected remedy include: (1) reduces contaminant mobility and toxicity; (2) results in long-term protection from contaminants; (3) does not restrict future industrial land use; (4) reduces the time required for remediation; (5) is cost effective compared with other alternatives; (6) is a proven method for cleaning up pesticide contaminated soils to very low levels.

VIII. STATUTORY DETERMINATIONS

EPA's primary responsibility at CERCLA sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA also requires that the selected remedial action for a site must comply with applicable or relevant and appropriate environmental requirements established under federal and state environmental laws, unless a statutory waiver is granted. The selected remedy must also be cost effective and utilize permanent treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, the statute contains a preference for remedies that include treatment as a principal element. The following discussion addresses how the new selected remedy for Sand Creek OU5 meets these statutory requirements.

A. Protection of Human Health and the Environment

The remedy selected for OU5 addresses the exposure or potential exposure to contaminated soil. The LTTT alternative is protective of human health by ensuring that the soil is cleaned up for industrial land use. If some soils require additional treatment due to elevated concentrations of metals, a contingency plan is in place to re-treat these soils. During LTTT, contaminants will be adsorbed onto activated carbon beds which will be transported off-site. Regeneration of the spent carbon will permanently destroy the contaminants.

TABLE 6. ESTIMATED COSTS FOR SELECTED REMEDY

	DESCRIPTION		COST
1.	Excavation (assume 9,200 cubic yds-115% of est. volume)	$	138,000
2.	Mobilization	$	600,000
3.	Low Temperature Thermal Treatment (LTTT)	$	2,622,700
4.	Spent Carbon Regeneration	$	6,400
5.	Treatability Studies	$	40,000
6.	Backfilling/Compaction	$	20,000
7.	Stabilizations/Solidifications	$	350,000
8.	Top Soil for Seeding	$	32,000
9.	Seeding	$	6,000
10.	Analytical (3% of Items 1-9)	$	114,453
11.	Engineering (10% of Items 1-10)	$	392,955
12.	Construction (10% of Items 1-10)	$	392,955
13.	Contingency (15% of Items 1-12)	$	707,319
	TOTAL	$	5,422,782

B. Attainment of Applicable, Relevant and Appropriate Requirements (ARARs)

The selected remedy of LTTT of contaminated soils and off-site treatment of spent activated carbon will comply with all chemical-, location-, and action-specific ARARs. The primary ARARs pertinent to the selected remedy are summarized below:

Chemical-Specific ARARs:

- Land Disposal Restriction (LDR) Treatment Standards (40 CFR 268 Subpart D)

Location-Specific ARARs:

- None

Action-Specific ARARs:

Federal

- A Public Health Evaluation (PHE) must be performed at least every 5 years . (CERCLA 121[c])
- Occupational Safety and Health Act (OSHA)
- Hazardous Materials Transportation Regulations
- The requirements of 29 USC Sections 651-658, and 29 CFR 1910.120, which regulate worker health and safety.

State of Colorado

- CRS Section 25-123-101, et. seq. must be followed to maintain compliance with the State of Colorado noise abatement requirements.
- 6 CCR 1007-3 Part 99 must be followed. This regulation requires notification of hazardous waste activities when hazardous waste is generated.
- The manifest requirements of 6 CCR 1007-3 Part 262 Subpart B must be followed for off-site transportation of hazardous waste.
- The pre-transport regulations of 6 CCR 1007-3 Part 262.30, .31, and .33 must be adhered to for off-site transportation of hazardous waste.

- An EPA identification number must be obtained for transporting hazardous waste per the requirements of 6 CCR 1007-3 Part 263.11(A).

- CCR 1001-3 Section VI.B regulates air emissions and must be followed.

Appendix A of the September 1990 ROD presents ARARs and To Be Considered (TBC) items pertinent to OU5.

C. Cost Effectiveness

The selected remedy is cost effective in mitigating the risk of exposure to contaminated soil. Cost effectiveness is determined by evaluating long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; and short-term effectiveness to determine overall effectiveness. The selected remedy meets these criteria and produces the best overall effectiveness in proportion to its cost. The estimated cost for the selected remedy is $5.4 million, which is 2 to 3 times less than the remedy selected in the 1990 OU5 ROD.

D. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost effective manner at OU5. Of the alternatives that are protective of human health and the environment and comply with ARARs, the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost, and also considering the statutory preference for treatment as a principal element and considering State and community acceptance. Long-term effectiveness and permanence, and cost were the most decisive factors in choosing the selected remedy.

E. Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for treatment as a principal element and is fully consistent with the NCP. By treating the pesticide and metal contaminated soils at OU5 with a LTTT system, the selected remedy addresses the principal threat of potential ingestion and direct contact posed by the site through the use of treatment technologies. The modified remedy satisfies the requirements of CERCLA Section 121.

APPENDIX A

Record of Decision

Operable Unit 5, Sand Creek Industrial Superfund Site

Commerce City, Colorado

September 28, 1990